

# UV-Curable Hybrid Nanocomposite Coating to Protect Tether Polymer Materials, Phase I

Completed Technology Project (2007 - 2007)



## Project Introduction

To address the NASA need for coatings to protect and strengthen tether materials for Momentum-exchange Electrodynamic Reboost (MXER) technology, Luminit, LLC, proposes to develop a new UV-curable Hybrid Nanocomposite (UVHN) tether coating material matrix, based on hybrid sol-gel technology. Its principal innovations include (1) synthesis of titanium dioxide and zinc oxide nanoparticles by a sol-gel method to form a coating protecting against ultraviolet (UV) radiation and atomic oxygen (AO); and (2) novel use of 3-aminopropyltriethoxysilane as a coupling agent that strengthens the material matrix, and promotes adhesion to tether materials. These innovations enable the UVHN to meet the NASA requirements for coatings that protect existing tether technology from the effects of UV and AO in the LEO environment, with improved tensile strength and longevity of existing tether. In Phase I Luminit will develop a glass-like polymer hybrid sol-gel UVHN protective coating for NASA's tether polymer materials, and demonstrate that it is resistant to UV and AO. In Phase II we will scale up and optimize the UVHN process to cost efficiently produce UVHN material matrices for more comprehensive UV and AO resistance tests. The resulting product will make MXER propellantless propulsion more reliable in raising and maintaining spacecraft orbits.

## Anticipated Benefits

The UVHN coating material matrix has significant commercial applications, including transparent abrasion-resistant coatings in the fabrication of silica micro-optics, including microlens arrays, diffractive optics, binary optics, diffusers, dye immobilization in laser rods, and protective coatings. In the field of biomedical optics, sol-gel-based diffractive elements and Fresnel lenses are essential elements of endoscopes and microlasers. Passive sol-gel-based micro-optical elements can also be used in integrated optical devices and optical components. In addition, in high-power laser sources, sol-gel-based silica would be ideal because it has high temperature and laser damage thresholds. There is a very high probability for commercialization in applications such as sport goggles, auto windshields, windows in public transit vehicles, armored cars for law enforcement and VIP protection, and solar panels.



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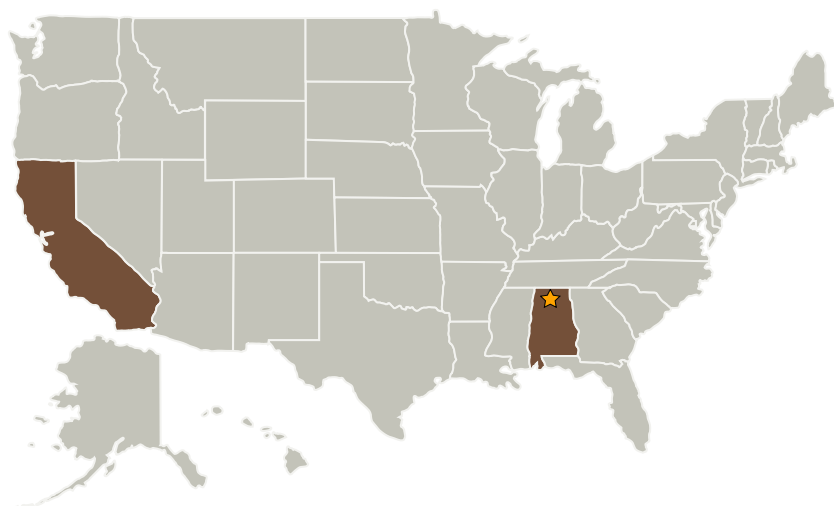
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Luminit, LLC	Supporting Organization	Industry	Torrance, California

Primary U.S. Work Locations	
Alabama	California

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Marshall Space Flight Center (MSFC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Project Manager:

Kirk F Sorensen

### Principal Investigator:

Kevin Yu

## Technology Areas

### Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.5 Coatings